The attached document is a supplement to the KB/LS proposal to be considered a TV band database administrator and includes information about the LS telcom existing product offering as referenced in the proposal.

PRODUCT DESCRIPTION

SPECTRA PROFESSIONAL
SPECTRA ENTERPRISE

LS TELCOM'S AUTOMATED SPECTRUM MANAGEMENT SOLUTIONS

LS telcom

Table of Contents:

1 SPECTRA System Professional Solution and General System Components

The ever increasing demand for frequency spectrum, generated to begin with the liberalization and deregulation of the telecommunications market, and furthermore due to new technologies, services and changing life style - constant communication and information access everywhere at every time - confronts network providers and regulatory authorities constantly with new challenges and requirements.

Licensing and frequency allocation processes have reached a maximum level of complexity owing to new technologies, services, and coordination activities going beyond national borders. Today, the scarce resource of frequency spectrum has to be assigned efficiently and without delay. Expectations of license owners have risen in line with the high fees charged for lucrative licenses. At the same time the end consumer expects high quality of service together with reasonable tariffs. Overall efficiency of spectrum allocation and use is vital to survive in a highly competitive market.

In order to address these challenges, LS telcom has developed a complete Software Tool Suite SPECTRA Professional covering the whole range of spectrum management tasks:

1.1 General System Description

The SPECTRA Core Spectrum Management Configuration is based on the central SPECTRA spectrum management database and includes the software modules SPECTRAplus, SPECTRAplan and SPECTRAemc to cover all fundamental administrative and technical aspects of spectrum management. The database stores and centralizes all license data, billing data, technical data, monitoring data, frequency plans and ITU notifications.

The system is highly scalable: it can be used by a small number of users only, but also fulfils the requirements of very complex system arrangements for a multi-user multi-access environment.

The general system set-up is shown in the following figure.

Please note that this drawing should serve as a general overview only, and not necessarily all modules and functions as presented in this figure will be included within the spectrum management system/database as planned to be used in the proposal. Nevertheless it demonstrates, that this solution is capable of doing what shall be covered now plus everything one may expect to be covered by such a solution in future..

All application, license and invoice processing tasks are carried out with SPECTRAplus. For strategic spectrum management including the administration of frequency plans and the handling of policies and regulations, SPECTRAplan is the required module. The SPECTRAemc module is used for planning, coverage calculations, interference analysis and frequency assignment.
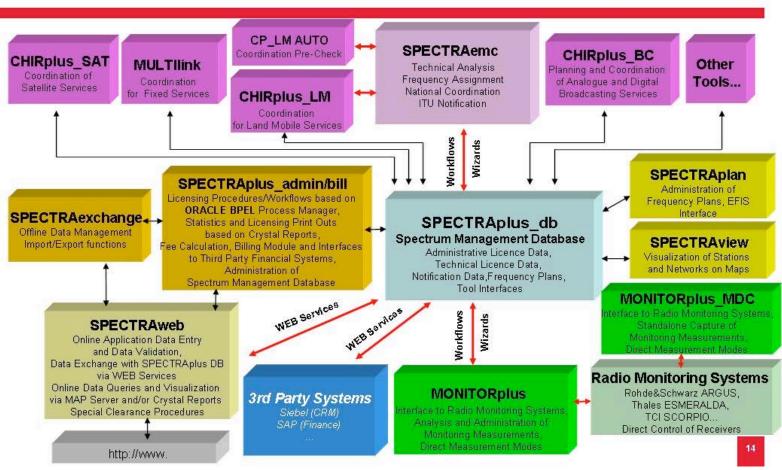
The Core Spectrum Management System can be interfaced with radio monitoring systems due to the MONITORplus interface. Another possible extension to the core system is the e-licensing solution SPECTRAweb. SPECTRAweb can be applied in an online and offline mode. SPECTRAview is mainly used by staff without access to other SPECTRA tools. It allows access to the central database using standard GIS functionality for visualisation purposes.

Furthermore, it is possible to extend the core system with technology specific radio planning and coordination modules according to particular needs.

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1.2 Functional Description

1.2.1 Basic Administrative Functions

Basic administrative functions of the system are application, license and fee processing. Automated application processing includes checking that all required information has been provided and that other conditions e.g. spectrum availability are fulfilled. Once this is the case and all fees are paid, a license may be ready to be issued.

The licensing function not only supports issuing of new licenses, but also renewal and termination of existing licenses and other numerous administration capabilities. License processing including printing of specific license forms is supported for all relevant radio services and sub-services. A deadline management and full workflow control supports the user in efficiently carrying out his day-to-day work.

An integrated billing module allows for comprehensive bookkeeping and service-specific fee calculation. Fee processing includes fee schedule maintenance and automated invoice generation.

Besides these basic functions the system supports a variety of other administrative activities from complaint processing to the generation of standard reports and administration-specific reports including vast statistical and management reporting capabilities. Other administrative functions and some details on the technical realization are described in the chapters further below.

1.2.2 Database Management

A decisive first step when implementing a spectrum management system is always to migrate the customer's data towards a new, ORACLE based solution. Also all the data records have to be analysed each one in particular to find out, whether the database entries are plausible, still valid and include sufficiently complete information as required by nowadays IT methods in spectrum management. This will reduce the amount of work for data integration significantly once a Spectrum Management System will come into operation.
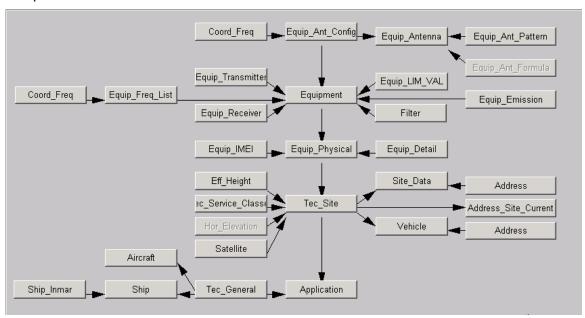
While some of these works (in particular the validation with reality) is something that the Customer need to carry out with its local expertise and knowledge about its licensed spectrum, there are also automated methods applied throughout the data migration process to check plausibility and completeness of information, and where appropriate to fill missing information by certain default values in accordance to pre-agreed rules.

For double checking data at the initial stage but also as an important measure for later data maintenance here are standardised import/export interfaces included which allow to approach data material of the ITU and to generate requests towards ITU and other international organisations. These interfaces are permanently adjusted when required so that users under
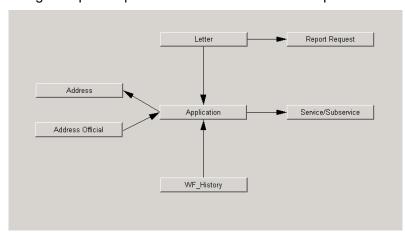
maintenance will always benefit from new available data sources in order to feed the Software with additional information like antenna patterns, Satellite data or newest coordination data.

Data from the existing Customer's database will be collected, evaluated, where required corrected and if possible also completed, and finally mapped and imported into the comprehensive data model of the central SPECTRA database.

Exemplary database structure -1

The internal data structure of the central SPECTRA database is very complex and comprehensive, in order to incorporate data of such different radio services like FM Broadcast, communication satellites, land mobile or fixed radio link services. Besides the technical structure of a single device like a TX or an RX also complete networks can be combined into one application, consisting out of many sites at different locations, multiple equipment at each site using multiple frequencies at dedicated antenna patterns.
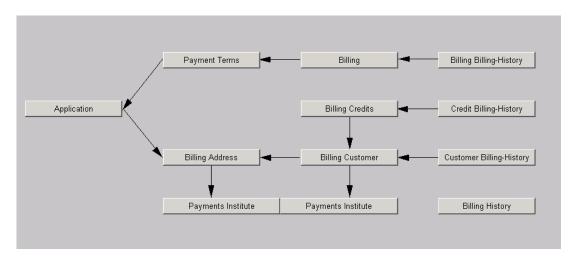
Exemplary database structure -2

Links with one to one relations between receivers and transmitters can be described as well as point-multipoint structures or single components.

Besides this technical structure, also organisational information like postal addresses, the names and reach-ability of responsible persons for a site or the owner information for sites/networks are stored. Ownership can even be shared between more than one persons or entities.

Administrative data is also kept in order to track processes like request letters or due dates.

Exemplary database structure -3
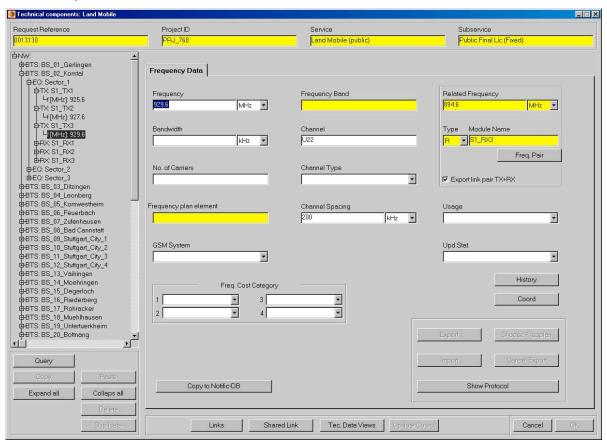
In addition, a whole subsection is only responsible for the charging of frequency usage, which may be useful to create billing notes towards internal users to make them aware and sensible for a responsible usage of the spectrum resource. Also it may be used in future for 3rd party sublicensing, once such procedure is allowed by the regulator.

Together with the extension SPECTRAplus_bill, the database handling tool includes a powerful billing module. SPECTRAplus_bill incorporates fully featured fee calculation, invoicing and accounting functions. Based on user configurable cost categories, billing strategies for e.g. cost per channel or bandwidth can be set up. Fees can be altered at any time for a specific service or sub-service, or also for a specific license case where necessary. Automated fee calculation can be done service-specific.

The included invoicing module allows to raise invoices based on the calculated fees and to trace their payment. If alterations of such a process need to be done, this is possible under the process customisation of the system. The billing functionality includes the creation of invoices, credit notes, reminders, manual bookings, the entry of payments and the trace of payment behaviour. Of course, the adoption of client-specific needs regarding fee calculation and book-keeping mostly requires extensive customisation.
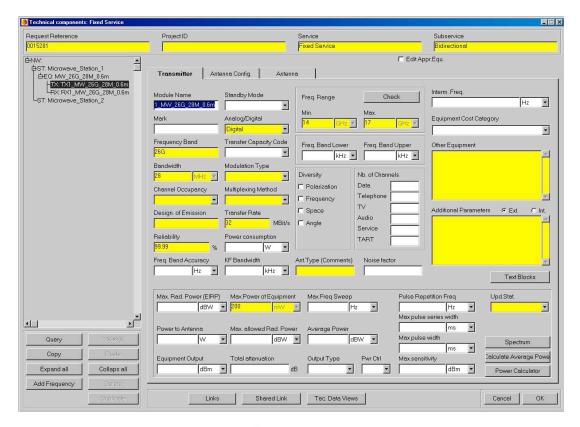
In order to maintain license data and enter new license applications for stations or networks, SPECTRAplus_admin offers several methods:

Exemplary data entry mask -1

Inside the SPECTRAplus_admin application, the user is capable to enter data for all possible services. Dependent on the service type, which may be selected at the start of the entry process, SPECTRAplus_admin generates the appropriate data structure and offers corresponding, specialized data entry dialogs. Because of the possibility of a powerful workflow control, these data may be coupled with complex actions based on the process step and the data content. Not all data have to be entered at the beginning; the information can be completed step by step as it becomes available to the user and considering the user's role and authorisation. So the user could e.g. start only with some administrative information about the requesting organisation part, the person in charge and the structure and type of the network.

Exemplary data entry mask -2

Time by time, while technical investigations are carried out, more information can be fed to the system about equipment, antenna pattern, links and so on.

While ensuring outstanding performance in a multi-user environment the RDBMS offers advanced security measures. An access control prevents from unauthorized data manipulation. Using a highly flexible data model main data types stored in the central database are:

- Administrative data

- Technical data

- Frequency allocations

- Monitoring data

1.2.3 Description of the Licensing Process

The proposed SPECTRA system solution is capable to handle and process licenses on network, station or frequency level.

The processing of a license application can be done along different business processes that might be different for different radio services or license products. An exemplary process is given in the picture below involving different departments and tasks.

The licensing process can be done completely within the proposed SPECTRA solution.
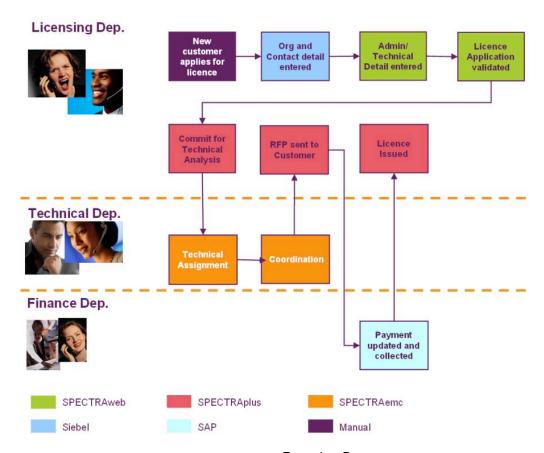
Typical steps that might be included (not necessarily all) in the different business processes for each license product could be:

- New Application Data Entry by the user

- Print Application Receipt

- Technical Analysis via generic EMC analysis or dedicated, radio service specific technical analysis modules (e.g. for broadcast, radio links, satellite, land-mobile).

- Spectrum Monitoring data gathering, obtaining reference field data (e.g. occupancy) to support the frequency assignment process. Besides the respective monitoring interface and functionality can also be used to support complaints processing and spectrum control / enforcement processes. A monitoring interface is available to all relevant current market radio monitoring systems for the control of the spectrum use.

- Load Channel Arrangement to cross-check the feasible assignment options with the national frequency plan.

- Frequency Assignment

- Interference Analysis

- National Coordination

- International Coordination

- ITU Notification

Frequency Assignment, Interference Analysis, National and International Coordination as well as ITU Notification will be done via our technical analysis modules. To simplify the user's daily work LS telcom has implemented a state-of-the-art wizard technology into the generic technical analysis module SPECTRAemc. These wizards can be user-defined and be executed fully- or semi-automatically allowing to run complex tasks in a manual semi-automatic (user interacts at some steps) or full automatic mode.

- Fee Calculation. Fees can either be calculated by the standard fee calculation functions included within SPECTRAplus, or by an external fee-calculation module. Our system solution offers also, as a matter of an optional extension and/or customisation, the possibility to interface to and interact with third party Finance Systems, e.g. SAP, for accounting, payment collection and controlling purposes.

- Print Proposal

- Issue License

Licensing Dep.

| New customer applies for licence | → | Org and Contact detail entered | → | Admin/ Technical Detail entered | → | Licence Application validated |

Commit for Technical Analysis

RFP sent to Customer

Licence Issued

Technical Dep.

Technical Assignment → Coordination

Finance Dep.

Payment updated and collected

| | SPECTRAweb | | SPECTRAplus | | SPECTRAemc |
| | Siebel | | SAP | | Manual |

Exemplary Process

Furthermore the proposed SPECTRA system solution is capable to handle and process licenses on network, station or frequency level. Irrespective of which licensing approach is taken by the customer a wide range of functionality is supporting the respective licensing process.

Licenses can be issued differently for different radio services depending on the character and specifics of the respective license products, e.g.:

- licenses manually issued

- licenses issued for network, station or frequency

- licenses granted on a temporary basis only or multi-year time limited with regular renewal

- licenses granted for a fixed location or on an area defined basis.

An integrated deadline manager and full workflow control supports the user in efficiently carrying out his day-to-day work.

The administrative spectrum management modules cover application processing including data entry, plausibility and compliance checks, coordination procedures, report printing etc.

The licensing process handling includes but is not limited to license issue, printout and renewal/variation/cancellation of licenses, fee-calculation, invoicing, and many more tasks.

The administration may vary from country to country taking into account international coordination and specific regional multi-lateral co-operation and special coordination agreements, ITU recommendations, international and national legal frameworks.

LS telcom's spectrum management system SPECTRA provides a comprehensive central database solution with versatile data querying and reporting capabilities for all needs of application processing and licensing as well as for management information, e.g.

- printing of licenses: different license formats for different radio services can be implemented and be printed out; printing functions comprise client-specific forms like licensing and invoicing forms and many others such as printing of selected records in a table (e. g. open invoices, open reminders, licenses to be printed, technical details of transmitters etc.)

- technical amendments or invoice documents

- a variety of statistical evaluations reports as for the statistics of use

- certification

- licensing

- invoicing

- printouts of selected stations on a map or tables containing the queried stations and their key parameters

- number of issued licenses

- amounts of collected fees

- list of all licensees or certifications of the past period

- quarterly or annual reports

- number of complaints, number of jobs performed

- license withdrawals or refusals and others

- printing of complaint acknowledgement

- printing of complaint resolution report and

- ITU approved standard form sheets for international coordination such as various AP forms.

The system exceeds by far the corresponding ITU design guidelines for spectrum managements systems. It fulfils and exceeds the minimum functional requirements of the ITU-R recommendation SM.1370-1, such as:

- License application data entry and processing

- License application administration

- Licensing

- Vendor/dealer recording

- Radio operator certification

- Equipment recording and notification

- Frequency selection

- Technical analysis

- Coordination

- Inspection and interference complaints

- Monitoring system interface

The proposed SPECTRA system solution is capable to support all relevant life-cycles of a radio license once issued. i.e. renewal, variation and termination by either surrender or cancellation. For each of these different cases specific standard business processes have been implemented, assuring a consistent processing of such license status modification within the system. This means that e.g. fees or fines are consistently calculated; the database is appropriately updated to consider any such change in future technical analysis and administrative licensing processes.
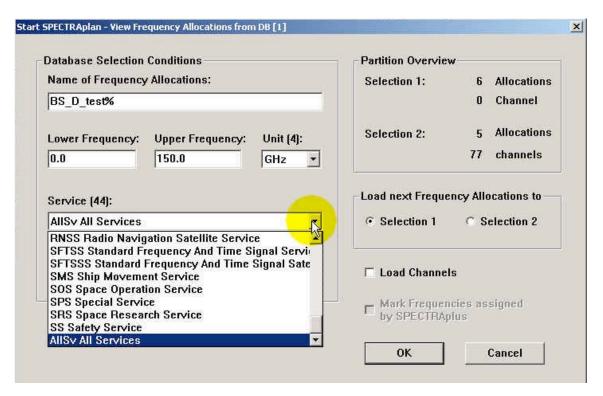
Along with the core functionality to support these license life-cycle-related processes also appropriate archiving functions are implemented, assuring that the life-cycle of a license is appropriately logged in the system and can be retrieved for any later prove purpose.

An integrated deadline manager and workflow control assures that the user can efficiently carry out his day-to-day job while not missing any relevant deadline.
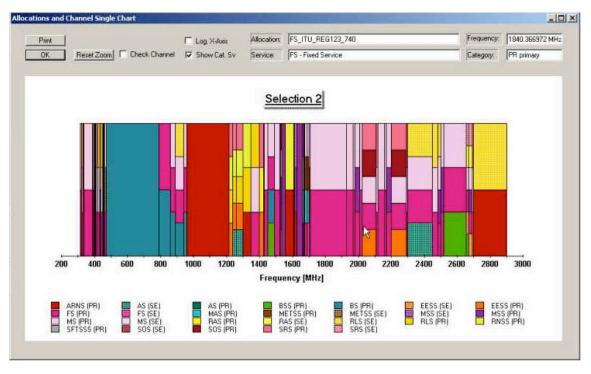
1.2.3.1 Spectrum Planning

Generation and administration of frequency plans including channel allotments is done by our spectrum planning tool SPECTRAplan. Besides the client specific frequency plans that can be implemented, SPECTRAplan also incorporates the ITU Frequency Allocations as standard configuration. It also provides functions to import data from the International Frequency List on CD-ROM and from the ITU Radio-Communication Information Circular/Local Frequency List. The SPECTRAplan module incorporates facilities for maintenance of frequency band channel allocations, descriptions and footnotes. It can even perform various channel calculation procedures and allows to graphically displaying the frequency allocations.

Frequency Allocation selection mask

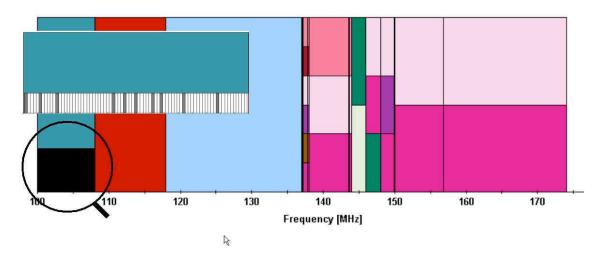*Exemplary Display of a frequency allocation chart -1*

Exemplary Display of a frequency allocation chart -2

SPECTRAplan supports the selection of free/occupied frequencies based on frequency allocations and channel allotments according to ITU RRS5 / WRC2000/2003/2007 and user defined frequency plans. Free/occupied frequencies can be visualized in 2D charts and in spreadsheets.

In terms of governance for the management of spectrum the system offers:

- definition and use of particular frequency plans as described above

- entry of user defined footnotes for each channel

- blocking and reservation of channels for assignment

- specification of numerous default values in the frequency assignment process (e.g. thresholds, search range of interferers etc.) which can be modified by special user rights only, to ensure consistent calculation and frequency assignment results.
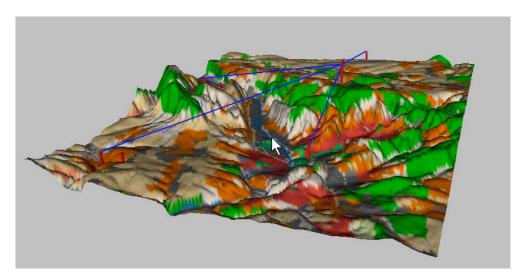
1.2.3.2 Electromagnetic Compatibility Analysis

All basic calculations that usually have to be done by regulatory authorities are supported by the below described tools. The functionality also covers inter-service analysis for shared bands e.g. potential interference between geo-stationary satellite earth stations and terrestrial microwave stations. The module SPECTRAemc provides propagation models for the complete radio frequency range from LF to EHF and also allows for basic planning tasks. Optionally more specialized tools for detailed analysis of certain services can be included e.g. HF or VHF/UHF analysis tools for analogue as well as digital services. Furthermore specialized tools for land-mobile services, for satellite services and terrestrial microwave networks can be added to the system as soon as a need arises. In the following, the description of features is limited to basic EMC analysis functions of SPECTRAemc only.

In order to analyse or to plan a new station or network, for most radio services SPECTRAemc is the appropriate generic tool to carry out technical analysis tasks.
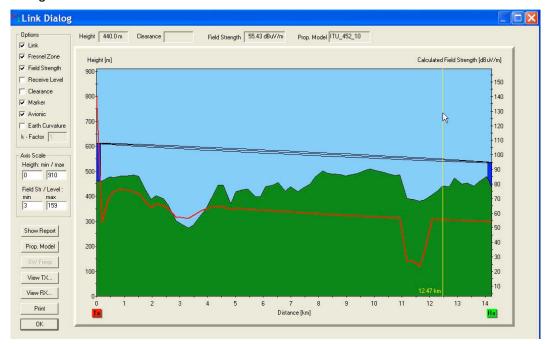
Initially a selection of existing stations in the targeted frequency range has to be done from the central database. The result may be a selection of TX or links on the screen. It may be displayed on normal 2D maps or, if topographic data is available, also as a 3D view. Especially in terms of links, this type of visualisation gives extremely good information concerning the quality of planning, possible problems as well as proposals for solutions.

Exemplary 3D display of a radio link network

For more detailed information, also simple path profiles may be drawn or paths of existing links being visualised.

Exemplary display of a radio link with terrain profile

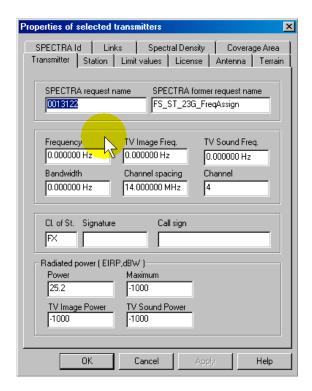New transmitters can be generated; containing a basic set of information and be prepared for tasks like frequency assignment.

For that purpose, the device data may be visualized and edited in a comfortable environment.

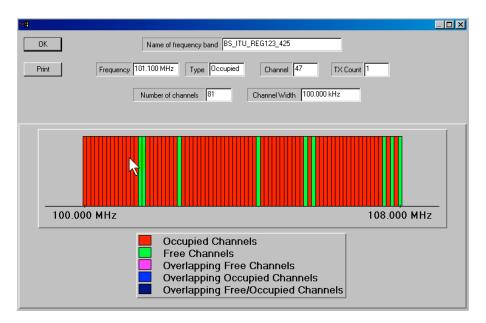*Exemplary editor window for a selected record*

1.2.3.3 Frequency pre-selection

Frequency pre-selection will usually be the first work to be performed in technical analysis.
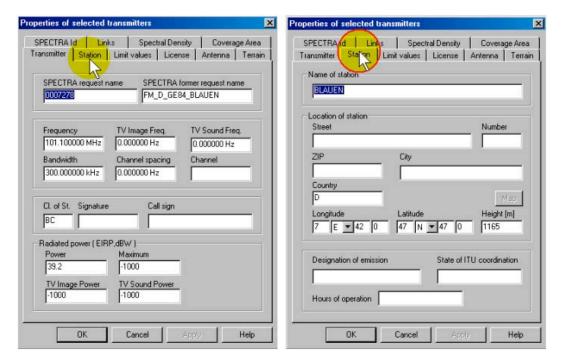
By that means, it is detected, which frequency ranges are available for the requested service and as well, whether there are any free channels available, which will grant the highest performance. The selection can be done in either of the tools SPECTRAplan or SPECTRAemc; both of them offer these possibilities.

After defining the frequency plan element, one would like to go with in terms of available hardware or other boundary parameters, which may limit the choice of frequencies further, a search in the database is carried out. As a result, the channel allocation for the desired frequency interval will be displayed, pointing out, which ones are occupied and which are the empty ones.
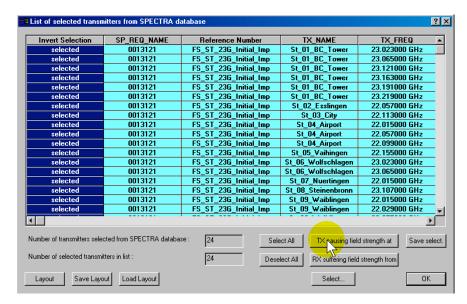
Frequency pre-selection information window showing details of frequency plan element

Frequency pre-selection information window when double-clicking on selected (occupied) channel

Occupied frequencies may also be a reasonable choice in order not to waste too much frequency space, if suffering can be limited to a useful value.
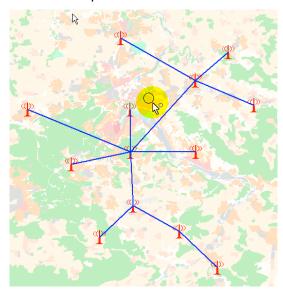
One of the selection possibilities of relevant license environment from the central database

1.2.3.4 Propagation / Coverage Analysis
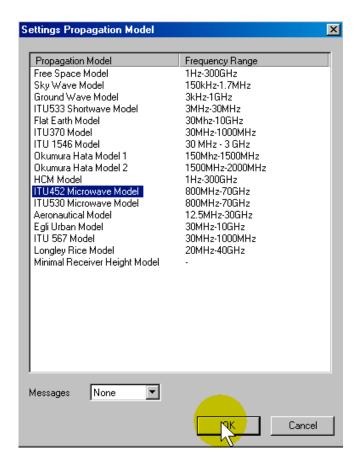
The result of a selection can be kept in a data table for further processing and analysis. The contents may be visualised on the map in order to get a geographical idea about possible interference problems.

View of radio link network on a background land-use map

On the map, test receivers can be created and positioned. They should be placed at locations, where the new station or network shall have its major coverage area.
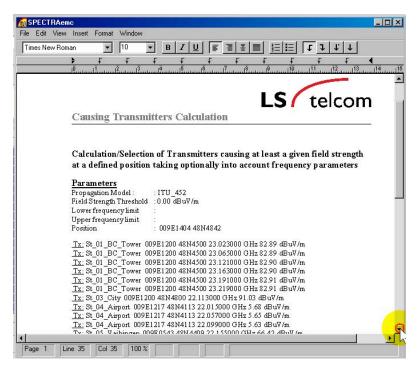
Exemplary set of tuneable and selectable propagation models
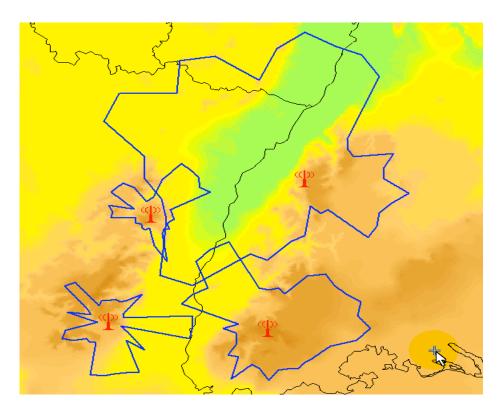
Using these receiver positions, a detailed field strength-analysis can be carried out, showing, which transmitters may really cause trouble. The prediction model can be selected according to the current needs. Models, which are configurable, also allow modifying calculation parameters to optimise the result according to the local situation.

As a result, a report is generated, explaining the potential suffering from the existing network for the new station/network.
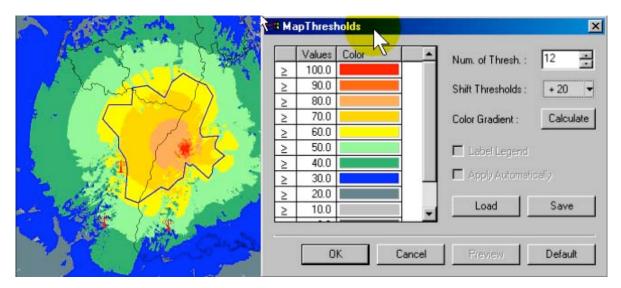
Exemplary text report of field-strength calculation

Exemplary coverage contour result of field-strength calculation
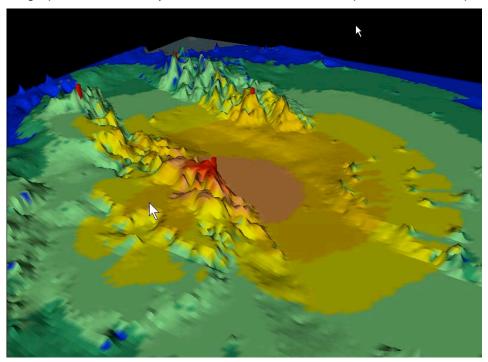
Such calculations can be carried out resulting in textual reports, coverage contours or area results as shown in the next figures.

Exemplary coverage area and contour result of field-strength calculation with colour editor

All graphical results may also be visualised on 3D maps for better interpretation.
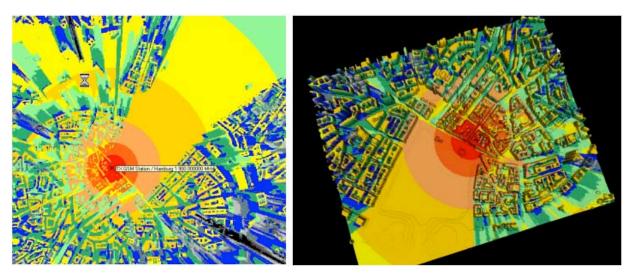
Exemplary coverage area result of field-strength calculation in 3D presentation on DTM background

Dependent on the used model and source data material, such results may be presented in quite spectacular ways using the different available GIS data layers and combining them with result data in overlay mode in 2D or 3D. As an example, a calculation for a cellular station in a urban area, based on 5m resolution data may be shown in the following:
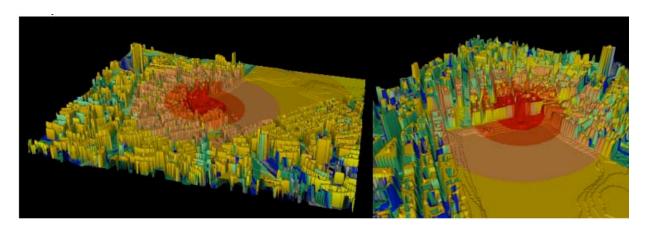
Cellular station in the city of Hamburg using satellite data background

Coverage result on a data background
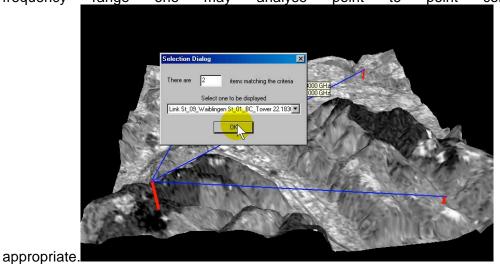
Coverage over 3D topo / land use information
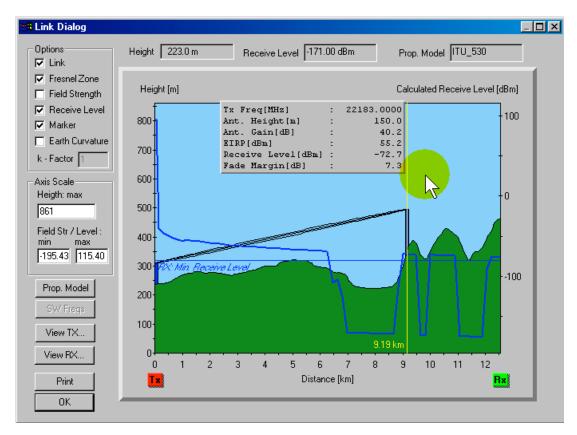
1.2.3.5 Link Station Analysis

Microwave and other radio links may also be analysed by the tool. Also within the shortwave frequency range one may analyse point to point connections where

appropriate.

Microwave link scenario with 3 sites and 2 links

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Microwave link presentation

For higher frequency ranges, path profile based results will be displayed, allowing to optimise the location of receiver and transmitter station. Using a sliding cursor, one may instantly check the field strength and fade margin while modifying the link arrangement.

1.2.3.6 Interference Analysis

For a given scenario, e.g. after a final frequency assignment, but especially also during negotiations, where new proposals may come up, a quick but powerful interference analysis is integrated. It is the same mechanism also the frequency assignment is based upon and will take into account all stations of all services within the whole frequency range under investigation. As a result, a report is created:

Interference Analysis

Interference Analysis

Parameters
Propagation Model :   : ITU_370

Result Options   : all critical

Rx: Test RX for COLMAR   007E3358 47N5629 93.500000 MHz 300.000000 kHz
  Calculated C/I : **-1.82 dB**   (Protection Ratio : 20.00 dB)
Linked Transmitter :
  Tx: COLMAR   007E0507 47N5427 93.500000 MHz 300.000000 kHz
  Calculated Power Level: **-64.86 dBm**   (Minimum Power Level   : -120.00 dBm)
Interfering Transmitters :
  Tx: FELDBERG SCHW   008E0000 47N5300 93.500000 MHz..300.000000 kHz
  Calculated Power Level: **-63.04 dBm**   (Minimum Power Level   : -120.00 dBm)
  Tx: HORNISGRINDE   008E1200 48N3700 93.500000 MHz..300.000000 kHz
  Calculated Power Level: **-69.66 dBm**   (Minimum Power Level   : -120.00 dBm)
  Tx: Vogesen_Nord 007E1832 48N2558 93.500000 MHz..300.000000 kHz
  Calculated Power Level: **-78.27 dBm**   (Minimum Power Level   : -120.00 dBm)

Interference Analysis finished for 1 Receivers
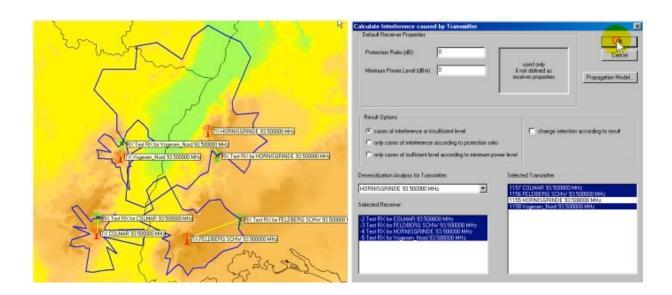
Though the example here has been taken from broadcast, these procedures are built in for all services and in each case consider the special behaviour of all different service type like bandwidth, spectral distribution or filter curve of the receiver.

1.2.3.7 Desensitisation Analysis

In order to analyse the effects of new stations to the existing network, especially also the increase of general energy on the receiver inputs on frequencies adjacent to the operated ones, the so-called desensitisation analysis has been integrated. It allows checking the decrease of sensitivity of a receiver due to uncorrelated and correlated interference suffering.

The system allows setting up a scenario or using the ones defined earlier.

As a result, again a report may be produced showing in detail, which stations may be suffering sensitivity reduction by the new network.

Desensitization Analysis

Desensitization Analysis

Parameters
Propagation Model :   : ITU_370

Result Options   : all critical

Tx under investigation: HORNISGRINDE   008E1200 48N3700 93.500000 MHz 300.000000 kHz
Rx affected: Test RX for FELDBERG SCHW   007E4554 48N1813 93.500000 MHz 300.000000 kHz
Calculated C/I : **-10.99 dB** before :4.05 dB   (Protection Ratio : 20.00 dB)
  Desensitization : 15.04 dB
Linked Transmitter :
  Tx: FELDBERG SCHW   008E0000 47N5300 93.500000 MHz 300.000000 kHz
  Calculated Power Level: **-64.85 dBm**   (Minimum Power Level   : -120.00 dBm)
Interfering Transmitters :
  Tx: HORNISGRINDE   008E1200 48N3700 93.500000 MHz..300.000000 kHz
  Calculated Power Level: **-53.85 dBm**   (Minimum Power Level   : -120.00 dBm)
  Tx: Vogesen_Nord   007E1832 48N2558 93.500000 MHz..300.000000 kHz
  Calculated Power Level: **-68.89 dBm**   (Minimum Power Level   : -120.00 dBm)
  Tx: COLMAR   007E0507 47N5427 93.500000 MHz..300.000000 kHz
  Calculated Power Level: **-75.76 dBm**   (Minimum Power Level   : -120.00 dBm)
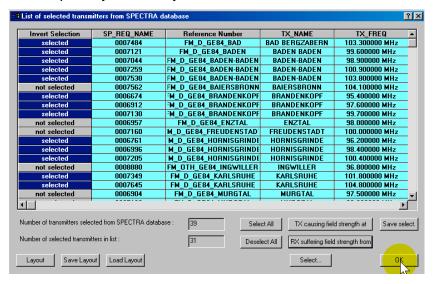
Desensitisation analysis graphical scenario presentation and text result report
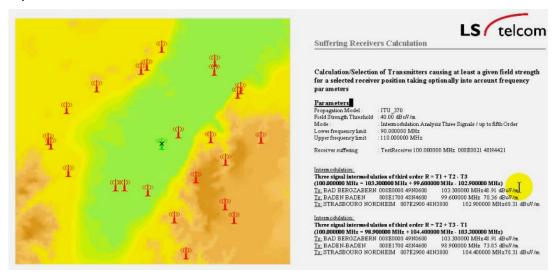
1.2.3.8 Intermodulation Analysis

In order to check, whether existing or new stations may suffer from intermodulation, a special feature has been integrated. It allows investigating several harmonic situations which is a real must especially at densely used tower sites with lots of stations.

Transmitter selection for intermodulation calculation

Based on the selection from the station table, sites under investigation are displayed on the map. Afterwards, a comprehensive investigation is started, resulting in an intermodulation report.

Intermodulation analysis scenario and text report

1.2.4 International Border Coordination

The SPECTRAplus system identifies all license applications requiring border coordination and offers powerful functions for the coordination of all services. ITU recommendations regarding border coordination including interference calculations and GIS based documentation of cases that require coordination are fully supported. As stated above, the necessary coordination forms of ITU may be printed out and edited if required.

1.2.5 Notifications to the ITU and Creation of Various Reports

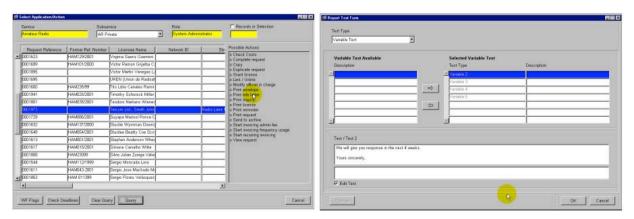Notifications to the ITU and the generation of different kinds of report are considered as basic administrative functions as described before. Frequency assignments that require the creation of appropriate forms are automatically detected and are reported with all necessary data filled in.

1.2.6 Analysis of Monitoring Measurements

The module MONITORplus represents the interface between the SPECTRAplus system and the radio monitoring system for the control of the spectrum use. MONITORplus allows for in-depth analysis and administration of monitoring measurements.

Typical Monitoring tasks of a regulatory authority include

- Monitoring of the usage of the spectrum

- Searching for interferer

- Searching for unlicensed transmitters

- Searching for transmitters that are not working with their licence conditions

All these basic monitoring tasks and many more are supported by MONITORplus. A central function of the module is checking for compliance of measured radio emissions with licenses. In order to relate measured signals with licensed transmitters the module has an ODBC interface
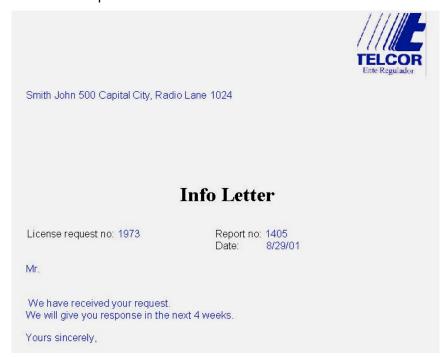
to the spectrum management database system. Technical data from licensed stations as well as monitoring data can be selected for all radio services. The Graphical user interface of the MONITORplus client application allows to simultaneously working with monitoring and technical data of the spectrum management system.

The module includes a GIS component for visualization of data on a map background and for the visualization of measurements in 2D/3D mode. An optional wave propagation upgrade allows for different kinds of technical analyses on the basis of propagation models for the whole radio spectrum.

1.3 Generation of Reports
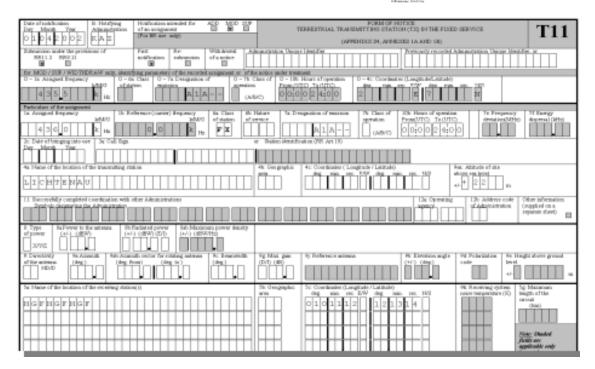
Report generation and report printing can be carried out at several locations inside the tool. A basic location for user adapted reports is usually the SPECTRAplus_admin application. Normally, an application (station/network) is selected by the operator. The possible print actions are listed and the proper one has to be started. The user is able, dependent on the type of report, to carry out modifications, or, for specific reports like a license or similar official documents, no changes can be carried out without special permission. The result is a report, like the examples shown below.

Smith John 500 Capital City, Radio Lane 1024

Info Letter

License request no: 1973   Report no: 1405
                                 Date: 8/29/01

Mr.

We have received your request.
We will give you response in the next 4 weeks.

Yours sincerely,

Besides the generation of invoices, notices, licenses, station and license reports, different statistical reports and management reports, a large variety of predefined and user-definable reports can be automatically generated.

2 SPECTRA System - Enterprise Solution
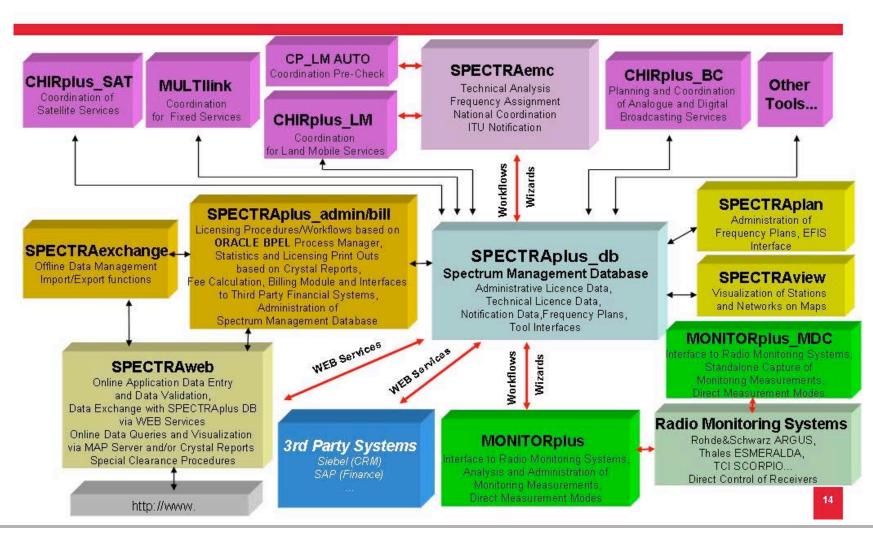
The top level solution for Spectrum Management goes indeed beyond the functionality of the SPECTRA Professional. Being based on the SPECTRA Professional platform the SPECTRA Enterprise Suite makes intense use of WEB services, a BPEL process engine and widely automated processes within the technical analysis. Also a WEB front-end, based on a strong middleware foundation completes the toolset for high end regulators needs.

The solution is very flexible in terms of configuration and may even be programmed by skilled professionals at the customer. The solution is designed for entities with 100+ employees, but may also be used by smaller entities who like to automate their work as far as regulations allow doing.

LS telcom

SPECTRA System – Enterprise Solution

LS telcom

CHIRplus_SAT
Coordination of
Satellite Services

MULTIlink
Coordination
for Fixed Services

CP_LM AUTO
Coordination Pre-Check

CHIRplus_LM
Coordination
for Land Mobile Services

SPECTRAemc
Technical Analysis
Frequency Assignment
National Coordination
ITU Notification

CHIRplus_BC
Planning and Coordination
of Analogue and Digital
Broadcasting Services

Other Tools...

Workflows / Wizards

SPECTRAexchange
Offline Data Management
Import/Export functions

SPECTRAplus_admin/bill
Licensing Procedures/Workflows based on
ORACLE BPEL Process Manager,
Statistics and Licensing Print Outs
based on Crystal Reports,
Fee Calculation, Billing Module and Interfaces
to Third Party Financial Systems,
Administration of
Spectrum Management Database

SPECTRAplus_db
Spectrum Management Database
Administrative Licence Data,
Technical Licence Data,
Notification Data, Frequency Plans,
Tool Interfaces

SPECTRAplan
Administration of
Frequency Plans, EFIS
Interface

SPECTRAview
Visualization of Stations
and Networks on Maps

MONITORplus_MDC
Interface to Radio Monitoring Systems,
Standalone Capture of
Monitoring Measurements,
Direct Measurement Modes

SPECTRAweb
Online Application Data Entry
and Data Validation,
Data Exchange with SPECTRAplus DB
via WEB Services
Online Data Queries and Visualization
via MAP Server and/or Crystal Reports
Special Clearance Procedures

WEB Services
WEB Services

Workflows / Wizards

3rd Party Systems
Siebel (CRM)
SAP (Finance)
...

MONITORplus
Interface to Radio Monitoring Systems,
Analysis and Administration of
Monitoring Measurements,
Direct Measurement Modes

Radio Monitoring Systems
Rohde&Schwarz ARGUS,
Thales ESMERALDA,
TCI SCORPIO...
Direct Control of Receivers

http://www.
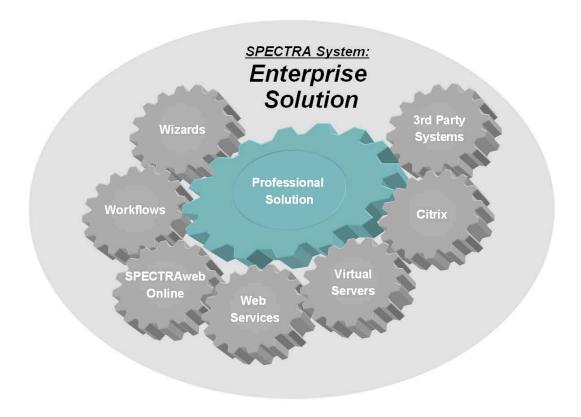
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2.1 General

Figure 2-1: Professional Solution / Enterprise Solution

2.1.1 Benefits

Benefits of the Enterprise Solution:	▪ Enhanced system handling with additional support tools e.g. BPEL engine, workflow management
	▪ Cost-Effective Licensing Schemes with Accurate, Efficient and Timely Billing
	▪ Increase public image of the organisation based on deliberated public transparency
	▪ Improved Level of Service e.g. Speed-up of licensing process
	▪ Application of WEB-Services thus sophisticated integration of 3rd party systems
	▪ Citrix Approved Terminal Server Solution with Easy Deployment of the System
	▪ Spectrum Trading Functionalities

2.1.2 Overview

LS telcom has introduced the concept of **WEB-services** to apply Service Oriented Architectures (**SOA**) into the SPECTRA enterprise solution. The backbone of the system is the ORACLE BPEL workflow engine for efficient definition of complex **workflows**. Implementation of such process flows are supported by graphical design tools based on industry standards.

Multiple functionalities of the SPECTRA enterprise system are now available as WEB-services and used by SPECTRA modules such as SPECTRAweb (**SPECTRAweb Online**) or SPECTRAplus_admin. Also customer defined **3rd party systems** may use and/or provide WEB-services for data exchange and triggering workflows steps depending on the results of selected tasks.

The next generation of spectrum engineering solution is based on this advantageous architecture offering a solution with scalable performance and open architecture.

With the wizard technology for SPECTRAemc, complex technical analysis can be done in an automated mode for any kind of service and frequency range.

The IT concept is based on a **Citrix** terminal server solution optionally combined with **virtual servers**.

Automated Application Processing

The enterprise solution allows for an automated application processing:

- Application business processes starts at the WEB-portal (new application, surrender, variation…)
- Integrated customisable workflows via Oracle BPEL for administrative business processes
- Customisable technical procedure via XML based wizard technology
- Seamless integration of administrative and technical processes
- Team management and service standards (key performance indicators) reports based on workflow history table

Example: New License Application Process

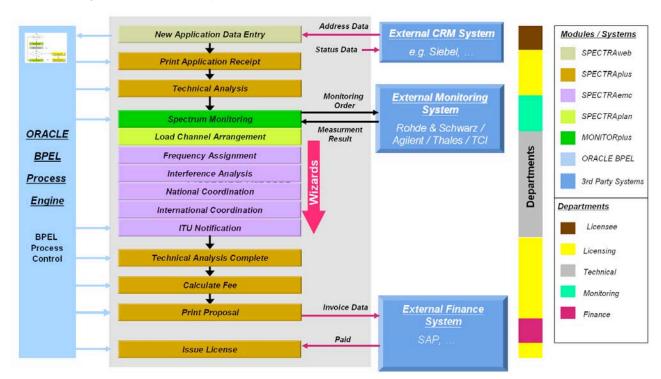The following picture shows a typical process for a new license application.

Figure 2-2: Process example for new license application

In the above visualized example, 5 departments (including the user), 5 SPECTRA modules and 3 external sub-systems are involved in order to process seamlessly the application. The Oracle BPEL Process Engine is controlling the complete process to ensure that all the required technical and administrative tasks will be done according to the defined workflow procedure. Depending on the result of the current workflow step the BPEL engine enables the required functionality for the next step. The complete technical analysis will be done with SPECTRAemc based on the procedure defined in the configurable service specific wizard. All the results of the technical analysis are stored in the database. The BPEL engine considers these results for the next action(s). With the enterprise solution the user will be guided by the system from the point of receiving an application via the web interface until the issuance of the license.